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## PRELIMINARY STUDY OF COUNCIL DIRECTIVE 92/43/EEC HABITATS IN GODECH MUNICIPALITY

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*Borislav Grigorov, Assen Assenov, Petko Bozhkov, Kiril Vassilev.* PRELIMINARY STUDY OF  
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The current paper represents a preliminary investigation of habitats on the territory of Godech Municipality, located in Western Bulgaria. It is based on the information, presented by the Ministry of Environment and Waters and the mapping of NATURA 2000 sites of Western Balkan Range and Forebalkan (BG0001040) and Dragoman (BG0000322). Data is processed with the use of the software product of ArcMap 10.1 This information will be used as a basis for terrain investigations, mapping and verification of habitats. The results of the study display that there is high abundance of different groups of habitats with typical vegetation for grasslands, shrublands and forests. Overall, 26 habitats are represented in the territory of Godech Municipality, which is relatively high for the geographic area that it covers. The investigation shows promising results that can be used as a basis for other research in this area.

*Key words:* habitats, investigation, Godech Municipality, vegetation.

## INTRODUCTION

The problem of identifying and studying the diversity of habitats is a question of current interest. The matter of their protection is important too, as the Millennium Ecosystem Assessment report (2005) warns that up to 20% of grassland and forest areas may be converted by the middle of this decade. Habitats' conservation is central for the EU as Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora points out. The Habitats Directive and the Birds Directive are the basis of Europe's nature conservation policy. Along with them, during the last 20 years a series of vegetation databases were developed, aiming at storing information about the vegetation that can be applied for habitat analyses. Such database is the European Vegetation Archive (Chytrý 2007–2013, EVA, Chytrý et al. 2016) – a continental-integrated database. The analysis approach for huge datasets (Landucci et al. 2015, Tichý et al. 2019) that is applied for identification of vegetation plots to habitats types for EUNIS also deserve attention.

NATURA 2000 network is being adopted in Bulgaria since 2002 and it includes 228 sites, taking up to 30% of the country's territory. Habitats are the main parts of these sites and they consist of: 12 coastal and halophyte habitats, 6 coastal sand and continental dune habitats, 6 freshwater habitats, 10 continental ericoid shrubland habitats, 18 natural and semi-natural grassland habitats, 4 wetlands, swamps and fens, 7 rocky habitats and caves and 27 forest habitats (Kavrakova et al., 2005). There are a number of studies, aiming on the investigations of vegetation and habitats in our country. Apostolova et al. (2001), Tzonev et al. (2009, 2014), Tzonev&Gusev (2017), Vassilev et al. (2012, 2014, 2016, 2019) studied vegetation and habitats in Bulgaria this investigation focus does not end with them.

The current study strives to unveil the habitat diversity in a section of Western Bulgaria, more specifically – the territory of Godech Municipality.

## OBJECT OF RESEARCH

The territory of Godech Municipality is 375,4 km<sup>2</sup> (fig. 1). The study object is located in West Bulgaria, within the boundaries of Sofia District. To the north, it borders with Berkovitsa and Varshets Municipalities, which both are confined within the perimeter of Montana District. The North boundary follows the main crest of Strara Planina Mountain (Berkovska and Koznitsa Mts.) and the upstream parts of Nishava River Valley to the south-west of the Gola Glava peak (1598 m above sea level) from where it follows Petrohan pass at about 1200 m. The municipality border follows the main ridge of Stara Planina Mountain range, reaching Varshets and Svoje Municipality to the East. In the southern direction, the border of Godech Municipality excludes the Poron and Mala Planina Mountains, encompassing the Godech Valley (also known as Zaburge or Zaburde). The Godech Municipality includes the northern

slopes of Chepan Mountain, separating it from Burel Valley within the area of Dragoman Municipality. The west border of the study area overlaps with the national border with the Republic of Serbia. Within these boundaries, the area of Godech Municipality is 375,39 km<sup>2</sup> or about 0,003% of the total territory of Bulgaria.

The geological settings in the Godech Municipality are very complex and diverse. The majority of the area of interest (about 171,8 km<sup>2</sup> or 47,77%) is build up by the rock of Iskar Carbonate Group (limestones, dolomitic limestones, dolomites and less shales, sandstones, siltstones) from the Lower – Upper Triassic (Angelov et al. 1992). The West Balkan Carbonate Group (28,24 km<sup>2</sup> or 7,52% of the study area, age Jurassic – Cretaceous) are presented in the southern parts of the administrative unit, covering the north slopes of Chepan Ridge (1205,5 m). The vast presence of carbonate rock is a prerequisite for karstification and development of various surface landforms such as karren fields, sinkholes, blind valleys and ponors (swallow holes). With total area of 51,73 km<sup>2</sup> or about 15,38% of the hole territory the rocks of Petrohan Terrigenous Group (breccia, conglomerates and sandstones formed during the Lower Triassic) are the second most common rock strata. Outcrops of Intrusive rocks are located in Berkovska Mountain, around Lisinski vrah (1630,8 m). Quaternary alluvial deposits cover the floodplains and terraces of all rivers, especially in Godech Valley (Zburge).

Most of the mountains and ridges are with parallel to subparallel orientation (W-E to NW-SE). The highest point within the boundaries of the administrative unit is Srebarna peak (1931,3 m) in Berkovitsa Mountain, whereas the Godech Valley is with elevation about 650–700 m. Several cycles of tectonic uplifting and subsequent denudation during the time of relative stability caused the formation of 4 denudation surfaces – Early Miocene (at 1600–2000 m), Late Miocene (1200–1500 m), Early Pliocene (800–950 m), Late Pliocene (600–650 m) (Gulabov 1966). The predominant part of the territory (about 50,04%) is with an elevation between 1000 and 1600 m, thus affecting the parameters of local climate by increasing monthly and annual precipitation sums and decreasing air temperatures. Lands with an elevation between 600 and 1000 m cover significant areas (45,78% of the territory), located along main rivers and their tributaries.

The main river within the area of Godech Municipality is Nishava with a length of 39,52 km from its source nearby Kom peak (2015,8 m) to the south border with Dragoman Municipality. Its valley in the upstream area has linear form following the orientation of main Stara Planina Range. The direction suddenly changes as the river bed turns in submeridional direction to the south and then again turns its course to the west. Similar drainage pattern is observed in the basin of Visochka (also known as Srebarna) River. Within the Godech Valley, the Nishava River takes its main tributaries Glutnitsa and Arakul River. After the confluence with Toplitsa, the Nishava River starts meandering and incising in the surrounding hills. Due to the presence of calcareous sediments, the karst topography is widely present. Therefore, many streams

are temporal (ephemeral) as water flow is present only in few months during the precipitation maximum and snow melting in the spring. Frequently a system of tributary blind valleys could drain into a single sinkhole, forming distinctive drainage pattern. It is observed very well around Gradishte peak (1528,4 m) in Koznitsa Mountain.

The variety of geological settings, landforms, and hydro-climatic conditions in the area of Godech Municipality determine the vast diversity of landscapes and ecological conditions which reflect the dominant vegetation and soil cover variations.

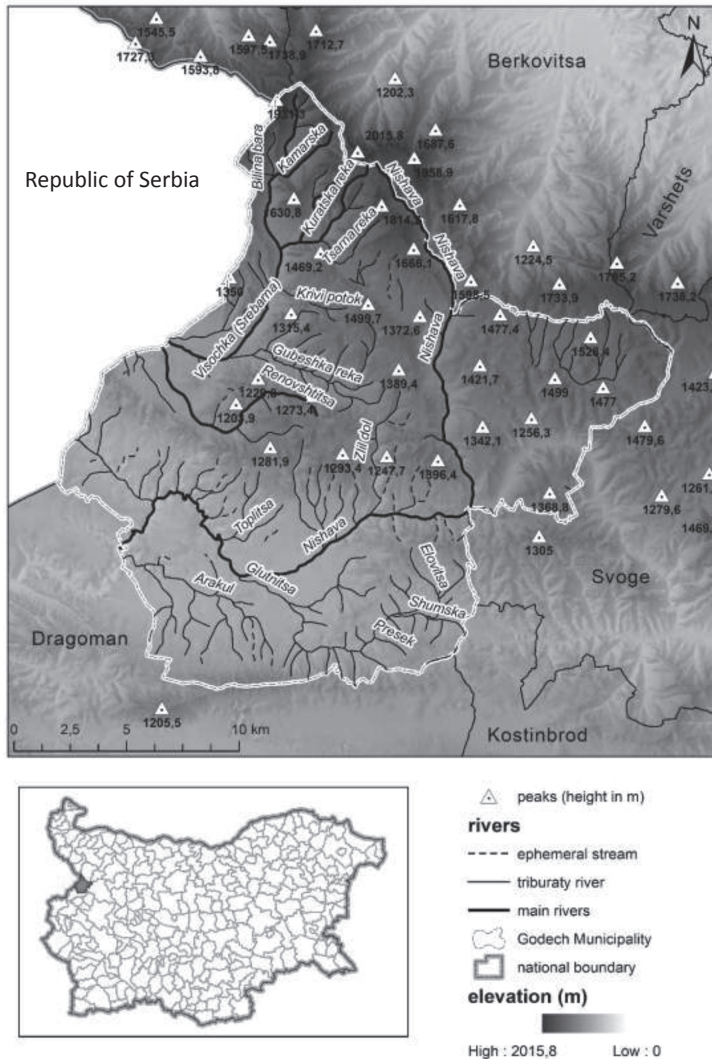


Fig. 1. Morpho-hydrography of Godech Municipality

## METHODOLOGY

The aim of this study is to identify the current habitats of Godech Municipality, which may be used as a foundation for a verifying investigation, that will include terrain research. The basis for this preliminary study is the information provided by the Ministry of Environment and Water (MOEW) for the two NATURA 2000 sites of Western Balkan Range and Forebalkan (BG0001040) and Dragoman (BG0000322). The comparative method will be used for the identification and analysis of habitats. The work includes only secondary information sources as a foundation. MOEW presents habitat data within the frame of single habitat code, that is included in a NATURA 2000 site. Every habitat, included in the two sites, was gathered and then the information was analysed with the software product of ArcMap 10.1. Habitats were combined within one map with the “union” tool for overlay analysis. Then data was derived only for the territory of Godech Municipality by applying the extraction “clip” tool. Then habitats were distinguished by their code and name and combined into three groups: grassland habitats; shrubland, wetland and rocky habitats; forest habitats. A fourth group was also derived, consisting of information about overlapping habitats. All these four groups are visually represented with maps within the next section. Outside the borders of the NATURA 2000 sites habitats are modelled, based on already existing information sources and these models are not checked by a terrain research, yet.

## RESULTS AND DISCUSSION

The results of the study are presented in the following lines. The territory of the two NATURA 2000 sites within Godech Municipality is 115,1 km<sup>2</sup>, which is making 30,1% of the whole area. Site Western Balkan Range and Forebalkan (BG0001040) and site Dragoman (BG0000322) include three main groups of habitats: 10 grassland habitats, 7 shrubland, wetland and rocky habitats and 9 forest habitats, making an overall habitat diversity of 26 types. Moreover, the focus of future studies has to aimed at the combination of 14 overlapping of habitats that are a part of the three main groups and they will be discussed in the next section.

The following lines are dedicated to the three main habitat groups, starting from the grassland types. These habitats are taking 73,5 km<sup>2</sup> or 19,6% of Godech Municipality (fig. 2).

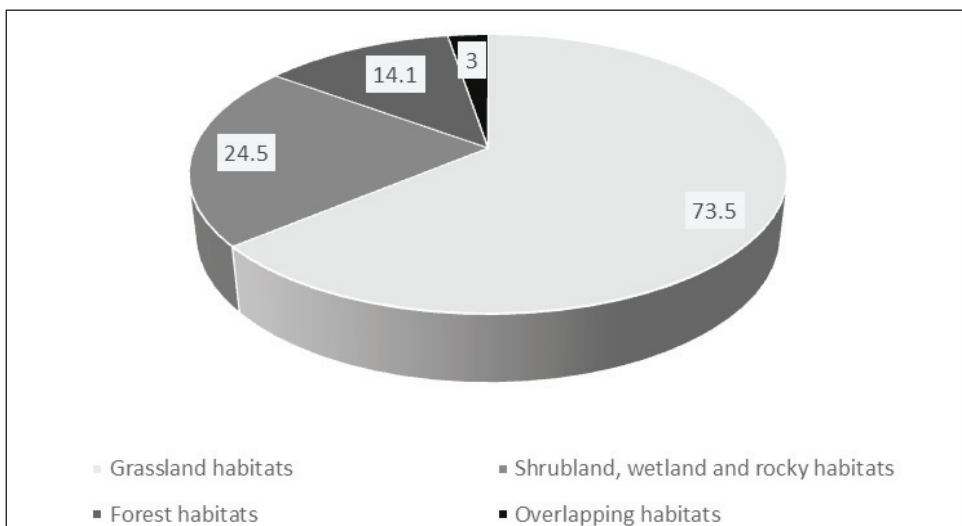


Fig. 2. Total habitat area (km<sup>2</sup>)

Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (\*important orchid sites) (6210) is the habitat type with the largest area (53,1 km<sup>2</sup>) (table 1).

Table 1

Habitats in Godech Municipality

Grassland habitat	Area (km <sup>2</sup> )	Shrubland, wetland and rocky habitat	Area (km <sup>2</sup> )	Forest habitat	Area (km <sup>2</sup> )	Overlapping habitats	Area (km <sup>2</sup> )
6110	0,17	4060	18,91	9110	0,3	4060/6230	0,097
6210	53,1	5130	0,5	9130	0,2	4060/8220	0,03
6230	9,83	7140	0,16	9150	1,79	40A0/62A0/6110	0,96
6240	0,48	7220	0,005	9170	7,04	6110/6210	0,43
62A0	3,16	8110	0,7	9180	1,59	6210/9170	0,02
62D0	3,71	8210	2,64	91E0	0,04	6210/91E0	0,002
6410	0,35	8220	1,56	91H0	0,45	6210/91M0	0,04
6430	1,46			91M0	2,71	62A0/6110	0,6
6510	0,29			9530	0,0007	62A0/6110/6210	0,7
6520	0,91					62A0/6110/6210/9150/9170	0,0007
						62A0/6110/91M0	0,009
						6510/91E0	0,000001
						9150/9170	0,04
						9170/91M0	0,08

It is taking 72,3% of the total grassland area within the two NATURA 2000 sites and 14,2% of Godech Municipality (fig. 3).

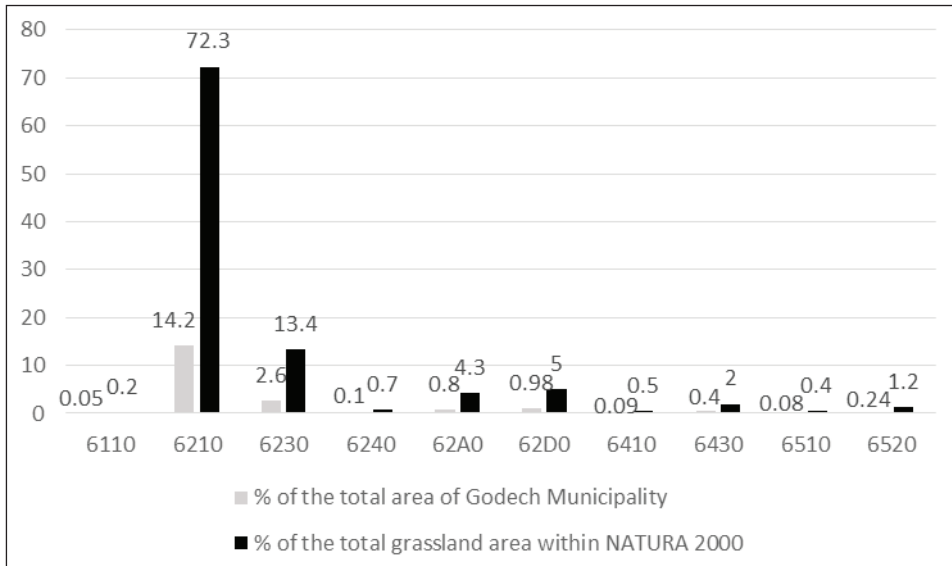


Fig. 3. Grassland habitats

The habitat type 6210 is distributed mainly in the central and southern parts of the municipality, in the mountains of Ponor, Berkovska, Vidlich and Chepun, while to the far north there is a lack of it (fig. 4).

The second place when it comes to territorial extent is taken by habitat type 6230\*species-rich *Nardus* grasslands, on siliceous substrates in mountain areas, taking 9,83 km<sup>2</sup>, which is 13,4% of the total grassland area within NATURA 2000 and 2,6% of Godech Municipality. Habitat type 6230 is distributed mainly in the mountains of Vuchibaba, Ponor and Vidlich with isolated areas in Berkovska Planina.

There are two habitat types that are taking more than 3 km<sup>2</sup>: Eastern sub-mediterranean dry grasslands (62A0) and Oro-Moesian acidophilous grasslands (62D0). The first habitat type is distributed to the west in the mountain of Vidlich and to the south of Godech Valley, while 62D0 is situated mainly in the southern parts of Berkovska Planina to the north.

The other grassland habitat types are as following: \*Sub-pannonic steppic grasslands (6240), *Molinia* meadows on calcareous, peaty or clayey-siltladen soils (*Molinion caeruleae*) (6410), Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (6430), Lowland hay meadows (6510), Mountain hay meadows (6520) and \*Rupicolous calcareous or basophilic grasslands of the *Alyso-Sedion albi* (6110). The last habitat type – 6110 is the one, having the lowest aerial extent – only 0,17 km<sup>2</sup>, accounting for 0,05% and 0,2% of the total municipa-

lity's area and the total grasslands territory within the NATURA 2000 sites, respectively. This habitat type can be found in Vidlich and to the north of Godech Valley.

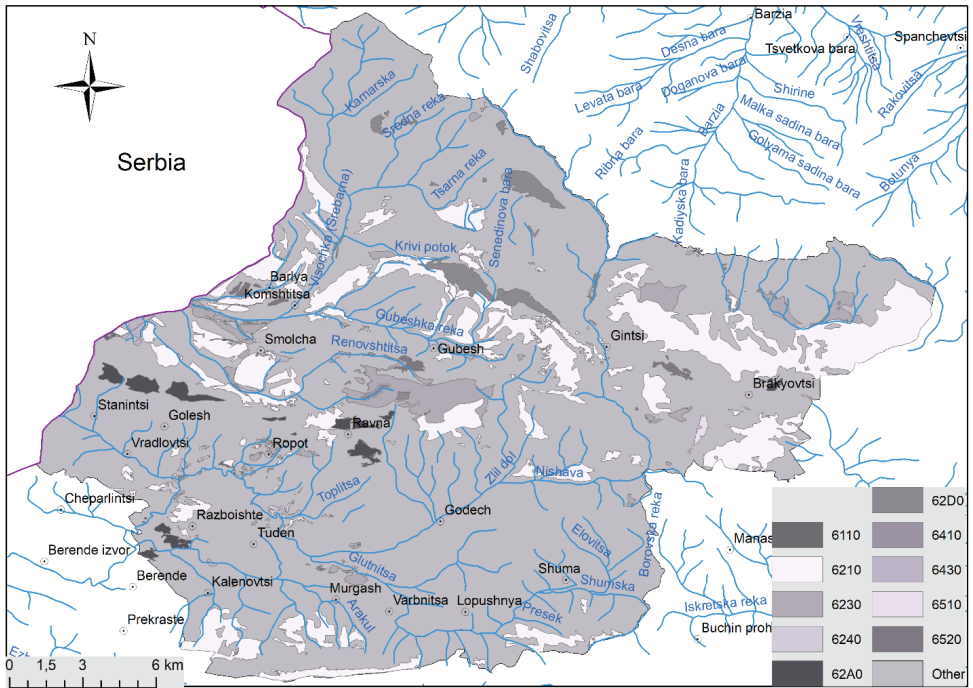


Fig. 4. Grassland habitats in Godech Municipality

The second habitat group is consisting of shrubland, wetland and rocky habitats (fig. 2, 5 and table 1).



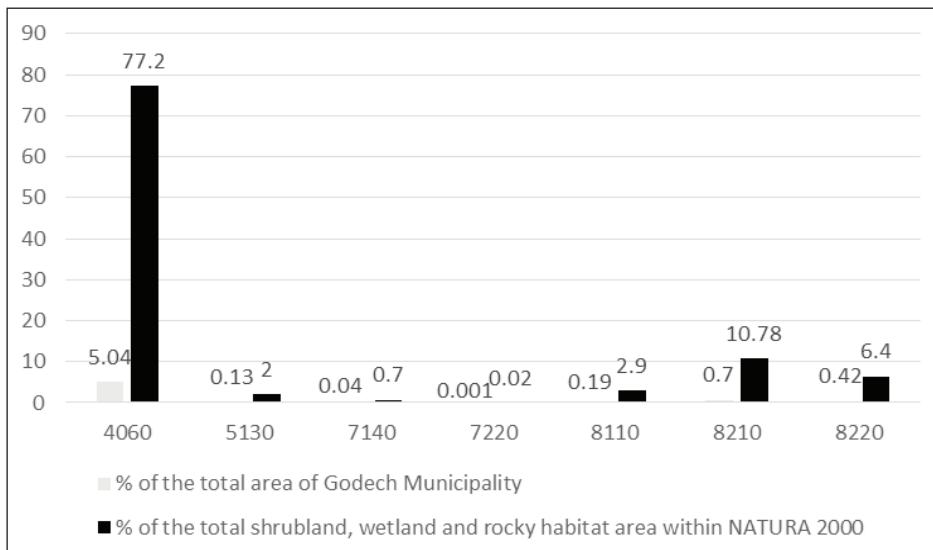


Fig. 5. Shrubland, wetland and rocky habitats

The group covers 24,5 km<sup>2</sup> or 6,5% of the municipality's area. The Alpine and Boreal heaths (4060) are taking 18,91 km<sup>2</sup>, which is equal to 77,2% of the total area of this habitat group and 5,04% of the municipality's territory. This habitat type is located only in the northern parts in the mountains of Ponor and Berkovska (fig. 6).

Calcareous rocky slopes with chasmophytic vegetation (8210) take the second place by territory with 2,64 km<sup>2</sup> or 10,78% of the total area of this habitat group. This habitat type is distributed mainly in Vuchibaba.

The other habitat types here are: *Juniperus communis* formations on heaths or calcareous grasslands (5130), Transition mires and quaking bogs (7140), Siliceous scree of the montane to snow levels (8110), Siliceous rocky slopes with chasmophytic vegetation (8220) and \*Petrifying springs with tufa formation (*Cratoneurion*) (7220). The last habitat type is covering only 0,005 km<sup>2</sup>, which is only 0,02% of the area of the group. This habitat type is located only to the northeast of Godech City in the valley of Nishava River.

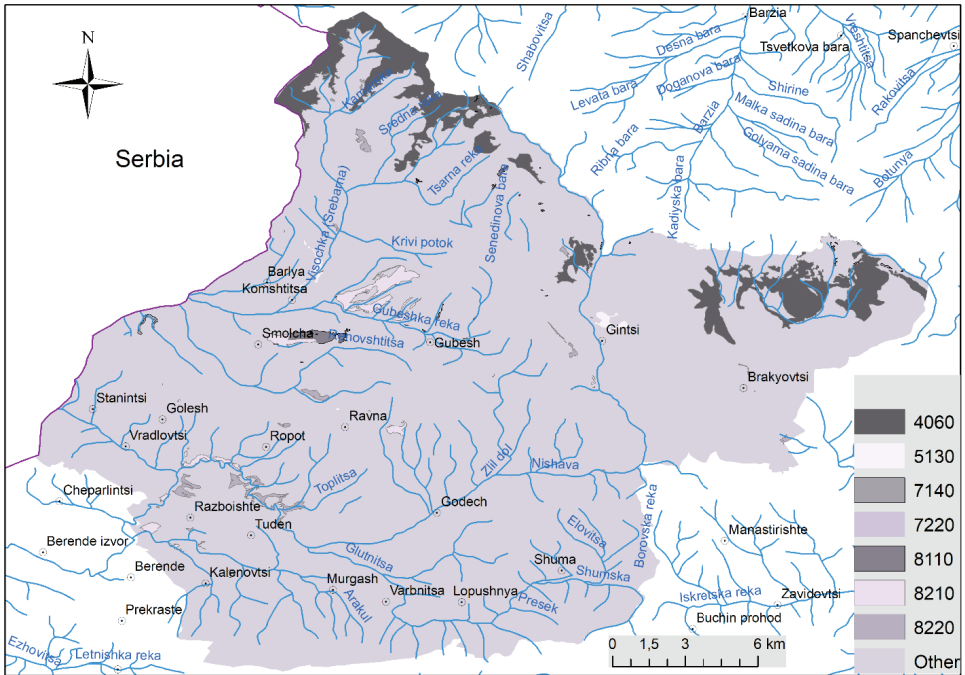


Fig. 6. Shrubland, wetland and rocky habitats in Godech Municipality

The next group is the one of the forest habitats. They cover 14,1 km<sup>2</sup> or 3,8% of Godech Municipality (fig. 2). The type that has the broadest distribution is the habitat of Galio-Carpinetum oak-hornbeam forests (9170), taking 7,04 km<sup>2</sup> or almost 50% of all forest habitats (fig. 7 and 8). Galio-Carpinetum oak-hornbeam forests are distributed mainly in the central and southern parts of the municipality, especially on the northern slopes of Chepun Mountain.

Pannonian-Balkan turkey oak-sessile oak forests (91M0) are taking the second place territorially with 2,71 km<sup>2</sup>, 19,2% of the total forest area within the NATURA 2000 site and 0,7% of Godech Municipality. This habitat type can be located only in the northern slopes of Chepun Mountain.

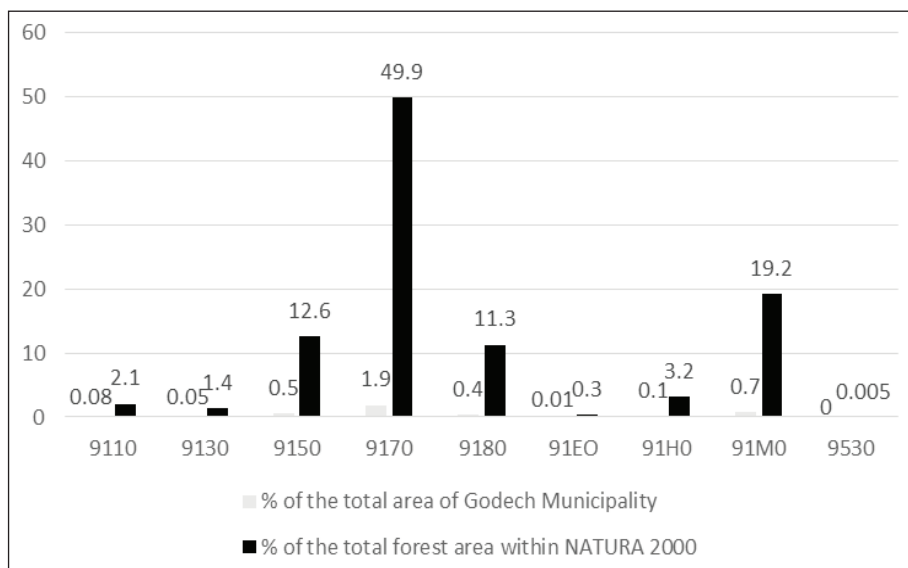


Fig. 7. Forest habitats

The other forest habitat types, that are represented in the territory of Godech Municipality, are as following: Luzulo-Fagetum beech forests (9110), Asperulo-Fagetum beech forests (9130), Medio-European limestone beech forests of the Cephalanthero-Fagion (9150), \*Tilio-Acerion forests of slopes, screes and ravines (9180), \*Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, *Alnion incanae*, *Salicion albae*) (91E0), \*Pannonian woods with *Quercus pubescens* (91H0) and \*(Sub-)Mediterranean pine forests with endemic black pines (9530). The presence of this habitat type within the municipality is discussible and it has to be verified during terrain research. It has the smallest territory – 0,0007 km<sup>2</sup> and can be located only to the southeast of the village of Vradlovtsi, located in the western part of the municipality.

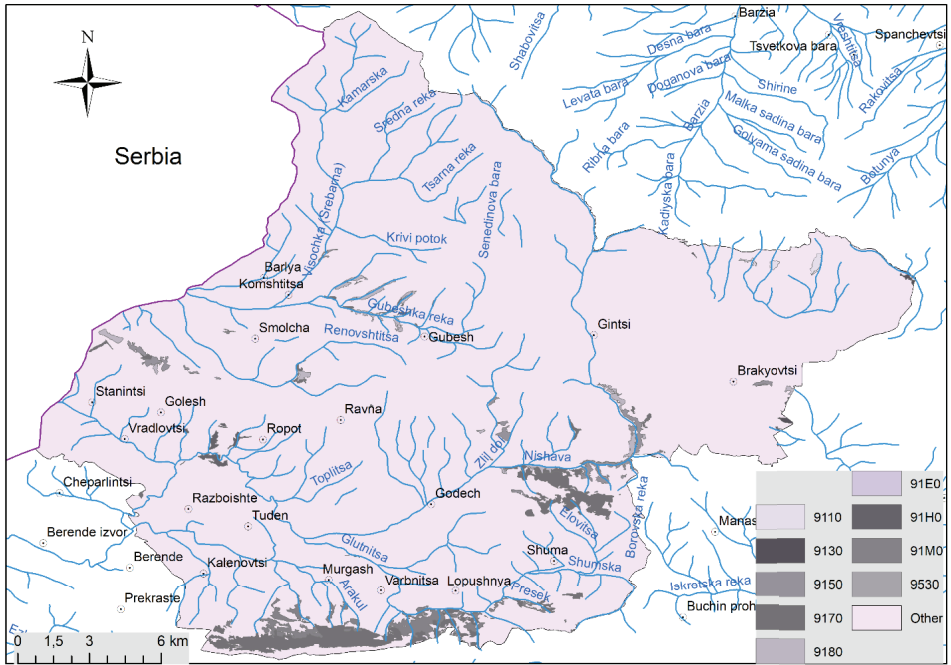


Fig. 8. Forest habitats in Godech Municipality

Last but not least in this section are overlapping habitats. They lack calculations about % of the total area of Godech Municipality due to the low territorial extent of each one of them (fig. 9 and 10).

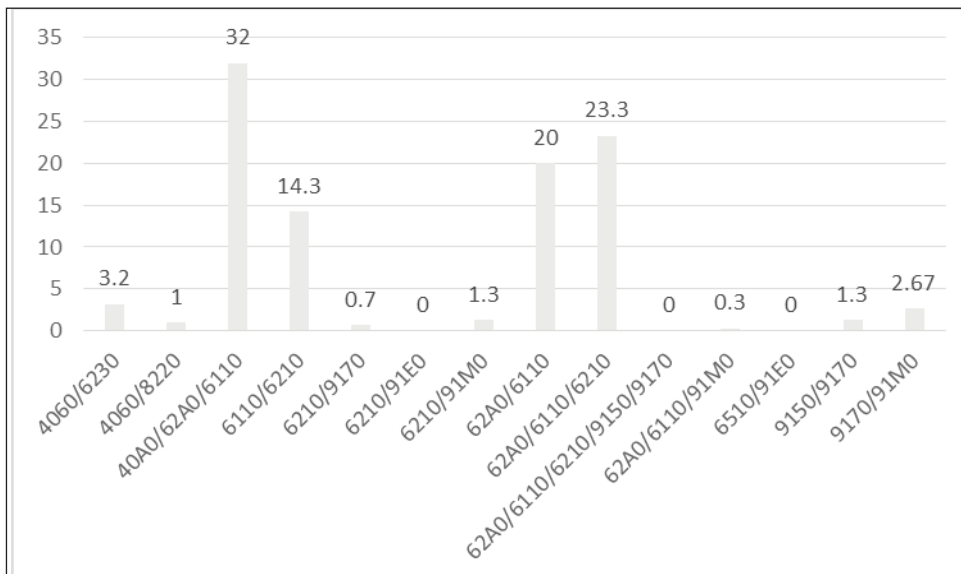


Fig. 9. Overlapping habitats

The majority of these overlapping habitats are located in the southern part of the municipality in Chepun Mountain, making them a part of the NATURA 2000 site of Dragoman. Terrain research has to study these habitats in particular, in order to distinguish them, especially when it comes to habitats that cannot take a particular territorial unit: 6210/9170, 6210/91M0, 62A0/6110/6210/9150/9170, 62A0/6110/91M0 or 6510/91E0 – all are examples of grassland and forest habitats, located in a single area.

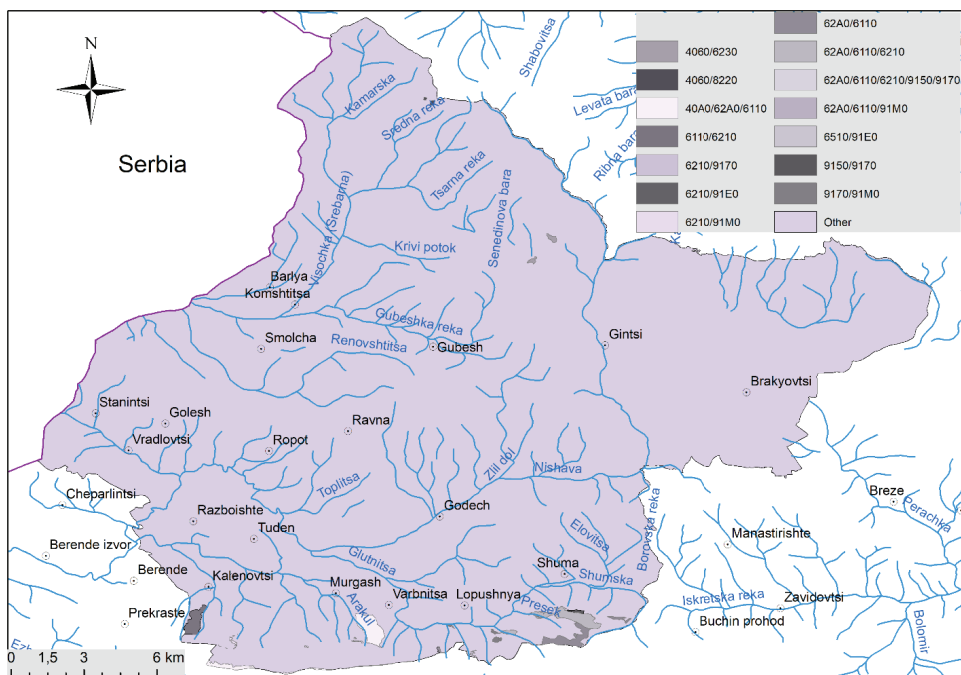


Fig. 10. Overlapping habitats in Godech Municipality

## CONCLUSION

The current investigation was built upon the provided data about habitat diversity in Godech Municipality that are falling within two NATURA 2000 sites: Western Balkan Range and Forebalkan (BG0001040) and Dragoman (BG0000322). The diversity includes 26 types. Moreover, there are 14 combinations that are overlapping that will need future studying in order to be properly distinguished.

Despite the occurrence of questions to be addressed, the authors of the present research believe in its successful outcomes. It has to be used as a basis for future studies and for broadening the geographic scope in the neighboring municipalities.

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